Poster #71

Confronting the Community Land Model Against Atmospheric CO_2 and Biospheric Datasets in the Western U.S.

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Forests in mountainous terrain represent a major carbon stock and potential for carbon uptake in the Western U.S. These forests are particularly vulnerable to climate change, which is expected to increase the frequency and severity of droughts, wildfires, and insect damage. Such disturbance events could weaken these forests' capacity to sequester carbon or switch them from a net carbon sink to a source. Despite the relevance of these mountain ecosystems, direct carbon flux measurements with eddy covariance towers are sparse, especially due to difficulties associated with complex topography. Land surface models, constrained by observed atmospheric CO_2 concentrations, emerge as an alternative for quantifying current carbon fluxes and projecting carbon dynamics into the future.

Here we simulate carbon fluxes and stocks in the Western U.S. with the Community Land Model, Version 4.5 (CLM), and assess the model performance against CO_2 observations at 3 mountain-top sites in the Regional Atmospheric Continuous CO_2 Network in the Rocky Mountains (Rocky RACCOON). The Stochastic Time-Inverted Lagrangian Transport Model, STILT, is used to link carbon fluxes simulated by CLM to CO_2 values at the observation sites. Meteorological fields from a high-resolution Weather Research and Forecasting (WRF) simulation are used to drive CLM and STILT during the summer of 2012, a period characterized by severe drought in the Western U.S. We also assess the performance of CLM against reference data products used in the International Land Model Benchmarking Project (ILAMB), including datasets on above ground biomass, leaf area index, and net ecosystem exchange.

Overall, the results show that CLM significantly underestimates carbon fluxes and stocks in the study region. We hypothesize that this is mainly caused by excessive soil moisture stress in the model due to poor representation of soil moisture over complex terrain that could be traced back to CLM's hydrology module and/or the atmospheric forcing data (especially precipitation and air temperature). New simulations testing the impact of different atmospheric forcing datasets on model performance will be shown.